



An observational record of *Kingsleya attenboroughi* Pinheiro & Santana, 2016 (Decapoda, Pseudothelphusidae), an endemic species from the Chapada do Araripe, southern Ceará, Brazil

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Abstract

We observed the occurrence of the pseudothelphusid freshwater crab *Kingsleya attenboroughi* Pinheiro & Santana, 2016 in an unexplored stream on the northern slopes of the Chapada do Araripe, Ceará state, northeastern Brazil. A female specimen of *K. attenboroughi* was found in a small pool of Gameleira stream, district of Missão Nova, municipality of Missão Velha, in the southern part of the state. The new occurrence record extends the geographic distribution of *K. attenboroughi* by 7 km beyond the Sítio Cocos, its easternmost previously known occurrence; this expands the geographic range of this species to the southeast and indicates that its real distribution is still poorly known.

Keywords

Brazilian semiarid, conservation, endangered species, freshwater crabs, Neotropical crabs

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Introduction

The Neotropical region has a wide diversity of primary freshwater crabs belonging to two families, Pseudothelphusidae and Trichodactylidae. The Pseudothelphusidae is the most diverse of these families, with approximately 290 described species (Yeo et al. 2008; Cumberlidge et al. 2014; Acevedo-Alonso and Cumberlidge 2021). In Brazil, most pseudothelphusids occur in the Amazon basin (Magalhães 2016); however, species have been

recently described in high-altitude swamps and humid forest zones of northeastern Brazil (Pinheiro and Santana 2016; Pralon et al. 2020; Santos et al. 2020a).

Pseudothelphusids tend to present a pattern of relatively restricted distributions, with a high degree of endemism (Rodríguez 1981; 1982; Magalhães 2016; Acevedo-Alonso and Cumberlidge 2021). This is the case of *Kingsleya attenboroughi* Pinheiro & Santana, 2016,

a species endemic to the Chapada do Araripe where it is restricted to two streams: Arajara stream (type locality; Pinheiro and Santana 2016) and a stream in the Sítio Cocos (Lima 2018). Both of these streams are located in humid forests on the northern slope of the Chapada do Araripe, municipality of Barbalha, southern Ceará, Brazil.

In general, pseudothelphusids inhabit clean water streams and suffer drastically from environmental variations; they are bioindicators of water quality (Campos 2014). Due to its restricted geographic distribution, *K. attenboroughi* has been described as at probable risk of extinction, mainly due to the habitat degradation (Pinheiro and Santana 2016).

The conservation status of *K. attenboroughi* is currently unknown, mainly due to the lack of data (Acedo-Alonso and Cumberlidge 2021). According to Dalu et al. (2017), identifying species' distributions is one of the main actions needed for their conservation. Given our poor knowledge of *K. attenboroughi* and that its conservation status would likely be one of the categories of a threatened species if properly assessed using IUCN criteria (IUCN 2022), we consider it important to report a new occurrence of *K. attenboroughi* based on observational data and expand this species' known geographical distribution.

Methods

We carried out sampling campaigns in November and December 2019 along three unexplored streams in the district of Missão Nova, municipality of Missão Velha, southern Ceará, Brazil. We used the active search method to collect the crabs, from 7:00 pm to 1:00 am, always with four researchers. In addition, we used traps made from PET bottles, which we distributed along the streams (adapted from Santos et al. 2020b).

We differentiated the sex of the crab according to the presence of pleopods in females and gonopods in males (Magalhães 2003). Next, we measured the carapace width (CW = distance between the lateral margins of the carapace), abdomen width (AW = width of the 4th abdominal somite for females and that of the 3rd for males), and propodus length (PL = distance between the base of the propodus and the distal portion of the fixed finger). We also measured the water temperature (WT), ionic hydrogen potential (pH), electrical conductivity (EC), and dissolved oxygen (DO) values when the presence of *K. attenboroughi* was confirmed in the stream. After obtaining the data, the crab was released into the same stream.

Results

Observation. BRAZIL – Ceará • Chapada do Araripe, municipality of Missão Velha, district of Missão Nova; 07°23'27.71"S, 039°12'45.80"W; 563 m a.s.l.; 19.XI.2019; J.G. Araújo, W.M. Nascimento, C.A.M. Martins, P.H.P.

Nobre obs.; 1 ♀.

Identification. *Kingsleya attenboroughi* as it is the only species of the family Pseudothelphusidae Ortmann, 1893, which is known to occur in the Chapada do Araripe. For more information, see Pinheiro and Santana (2016).

Remarks. We found only one specimen of *K. attenboroughi* in Gameleira stream, which is 21.7 km from the type locality in the Arajara district, and 7 km away from the Sítio Cocos, the only localities where the species has been previously recorded (Fig. 1). The specimen was a female (CW = 42.62; AW = 21.51), which was missing the left cheliped but had a right cheliped (PL = 19.91).

The specimen was observed under a leaf substrate in a small pool, approximately 30 cm deep and 2 m in diameter (WT = 24.9 °C; pH = 6.6; EC = 150 µS/cm; DO = 10 mg/L) (Fig. 2). We observed the female moving around, probably foraging. However, she did not move when we positioned the camera light towards her (Supplemental File, Video S1).

The stream was mostly dry and strongly fragmented into small pools of water, similar to the pool in which we found the female. We observed PVC pipes draining water from the stream for domestic use, as well as heavy pollution along the entire stream, with the presence of PET bottles and plastic bags.

Discussion

Our result points to a new occurrence of *Kingsleya attenboroughi* and, consequently, the expansion of the species' geographic range. However, the stream where the species was observed is heavily degraded, mainly due to the almost total extraction of water from the stream. This problem also occurs in the type locality (Pinheiro and Santana 2016; Lima 2018) and is one of the causes of environmental degradation in areas of the Chapada do Araripe.

The new record of *K. attenboroughi* outside the previously reported sites (Pinheiro and Santana, 2016; Lima 2018) indicates that the actual distribution of the species in the Chapada do Araripe is expected to be wider. This is a positive outcome for the future conservation of the species. The presence of this species in streams other than at the type locality increases the probability of the existence of more than one population, as reported for *Fredius ibiapaba* Santos, Tavares, Silva, Cervini, Pinheiro & Santana, 2020, another endemic pseudothelphusid which occurs in highland swamps in northeastern Brazil (Santos et al. 2020a).

Gameleira stream is similar to Arajara stream, although it is more degraded. Recent studies have shown that Pseudothelphusidae and Trichodactylidae seem to be very susceptible to extinction, mainly due to threats such as habitat destruction caused by agriculture, deforestation, urbanization, water pollution, damming of rivers, and introduction of invasive species (Cumberlidge et al.

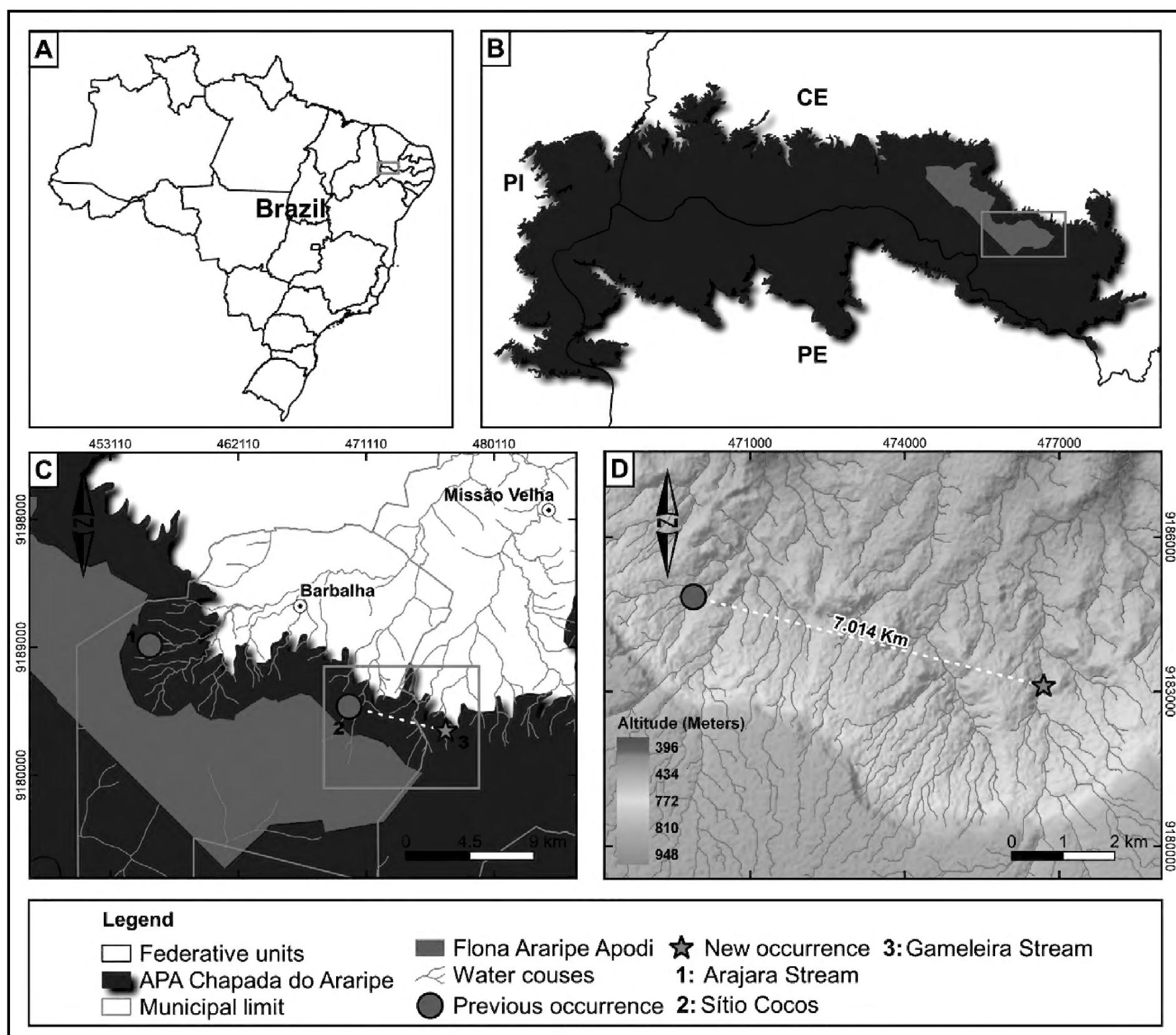


Figure 1. Geographical distribution of *Kingsleya attenboroughi*. **A.** Location of the study area in southern Brazil. **B.** Location of the study area in Chapada do Araripe Environmental Protection Area. **C.** Occurrence points. **D.** Digital elevation model with detailed drainage, indicating streams between Sítio Cocos and Gameleira stream; warmer colors indicate higher elevations. Dashed line = approximate distance between the new occurrence spot and the Sítio Cocos.



Figure 2. *Kingsleya attenboroughi* female on leaf in a water pool in Gameleira stream, district of Missão Nova, municipality of Missão Velha, Ceará, Brazil.

2009; Campos 2014; Magalhães 2016; Acevedo-Alonso and Cumberlidge 2021). Due to the scarcity of distributional, biological, and ecological data on *K. attenboroughi*, the conservation status of this species cannot yet be assessed using IUCN criteria, and it is Data Deficient (Acevedo-Alonso and Cumberlidge 2021).

Santos et al. (2020b) suggested that the channeling of water resources is partial in the areas where *F. ibiapaba* occurs in the Ibiapaba plateau. However, in Gameleira stream, *K. attenboroughi* is subjected to an almost complete channeling of its flow for domestic and agricultural use. Along with as well as stream pollution, these are the same impacts observed at the type locality (Pinheiro and Santana 2016). Although preliminary, these observations suggest that this species may be Critically Endangered, mainly due to declining habitat quality. The channeling of water resources in Gameleira stream, as well as at the type locality, seems to be the main threat to *K. attenboroughi*. To alleviate this critical situation, we suggest that natural water flow be maintained in streams where the species occurs. However, to accomplish this, local communities' understanding of the importance of conserving of the aquatic fauna must be raised. Therefore, we suggest that environmental education aimed at the conservation of *K. attenboroughi* be carried out in local communities.

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Authors' Contributions

Conceptualization: JGA, WMN, CAMM, PHPN, APP. Data curation: JGA, WMN, CAMM, PHPN. Formal analysis: WMN, CAMM. Funding acquisition: APP. Investigation: JGA, WMN, CAMM, PHPN. Methodology: JGA, WMN, CAMM, PHPN. Project administration: APP. Resources: APP. Software: CAMM. Supervision: WMN, APP. Validation: WMN, APP. Visualization: JGA, WMN, CAMM, PHPN, APP. Writing – original draft: JGA, WMN, CAMM, PHPN, APP. Writing – review and editing: JGA, WMN, CAMM, PHPN, APP.

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Supplemental File

Video S1. Female of *Kingsleya attenboroughi* observed during field expedition in Gameleira stream, district of Missão Nova, municipality of Missão Velha, Ceará, Brazil.